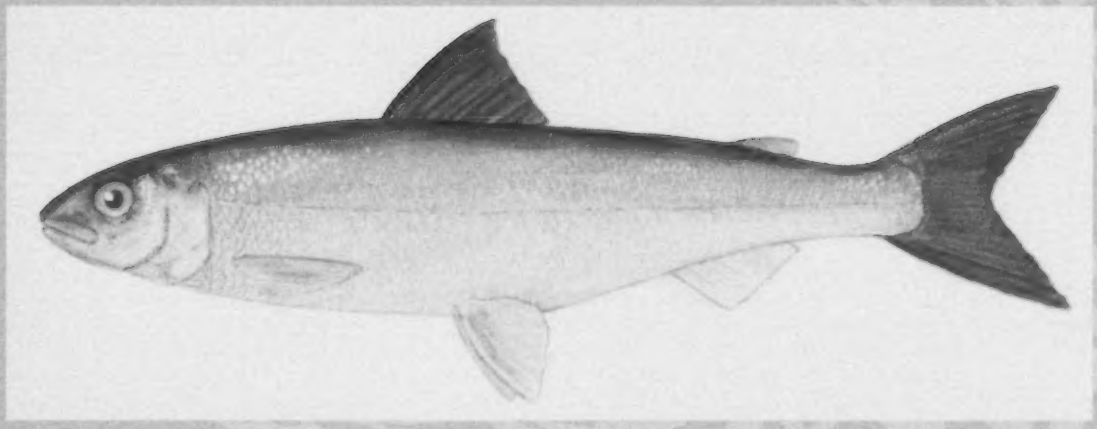
Species at Risk Act
Recovery Strategy Report Series

Report on the Progress of Recovery Strategy Implementation for the Atlantic Whitefish (*Coregonus huntsmani*) in Canada for the Period 2007-2012

Atlantic Whitefish



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Preface

Section 46 of the *Species at Risk Act* (SARA) requires the competent Minister to report on the implementation of the recovery strategy for a species at risk, and on the progress towards meeting its objectives within five years of the date when the recovery strategy was placed on the SAR Public Registry.

Reporting on the progress of recovery strategy implementation requires reporting on the collective efforts of the competent Minister, provincial organizations and all other parties involved in conducting activities that contribute towards the species recovery.

Executive summary

The Minister of Fisheries and Oceans Canada (DFO) is the competent minister for the recovery of the endangered Atlantic Whitefish (*Coregonus huntsmani*) under the *Species at Risk Act* (SARA). DFO has led the development and implementation of the strategic directions set out in the *Recovery Strategy for the Atlantic Whitefish (Coregonus huntsmani) in Canada* (DFO 2006), published in February 2007, in collaboration with many different constituencies, including the long-standing multi-stakeholder/multi-interest advisory Atlantic Whitefish Conservation and Recovery Team (AWCRT; Appendix A).

This report addresses recovery progress since the publication of the original Recovery Strategy in February 2007 (DFO 2006). The original Recovery Strategy was amended in 2016 (DFO 2016a) to take into account new information and changed conditions, which are detailed in its Preface. The Recovery Strategy was amended concurrently with the development of the Action Plan (DFO 2016b) and of this Progress Report. Accordingly, all references to the Recovery Strategy (unless otherwise specified) are to the 2016 amended Recovery Strategy, as this amended version updates and replaces the original Recovery Strategy. An update on the status of a number of completed or ongoing recovery activities are included in the amended Recovery Strategy. Accordingly, much of the activities and progress towards recovery are therein reflected and are summarized herein again.

The amended Recovery Strategy maintains the original overall goal for Atlantic Whitefish recovery, namely to *"achieve stability in the current population of Atlantic Whitefish in Nova Scotia, reestablishment of the anadromous form, and expansion beyond its current range"*, as well as the four broad strategies for recovery which remain relevant and realistic for Atlantic Whitefish recovery. However, the 2009 Recovery Potential Assessment (RPA) provided new information that allowed for the establishment of population and distribution objectives as well as the inclusion of a number of measurable performance indicators that are used in this report to assess the first five years of progress towards implementation of the 2007 published Recovery Strategy.

The accomplishment of a number of scientific achievements, management activities undertaken, and the initiation of a number of recovery efforts have assisted in progress towards ensuring that the Recovery Strategy goal is achieved and will require the continued implementation of additional actions, which have been identified and prioritized in the Action Plan for the species.

The main areas of achievement towards recovery within the February 2007 to February 2012 time period include:

- Advancement in captive-rearing techniques, including cryopreservation of Atlantic Whitefish milt.

- Evaluation of the feasibility of using captive-reared Atlantic Whitefish for introductions in new areas and the promising outcomes to date with introductions into Anderson Lake, a lake outside the Petite Rivière system.
- Provision of fish passage at Hebb Lake Dam to ensure survival of the existing wild population of Atlantic Whitefish in the Petite Rivière lakes and begin to create the conditions to enable anadromy on the Petite Rivière.
- Increased knowledge of the species and its habitat.
- Increased fishery and habitat compliance monitoring on the Petite Rivière.
- Identification of critical habitat necessary for the species survival.
- Increased local community awareness and engagement on the Petite Rivière.
- Development of an Action Plan to address the species' entire global distribution with the intent of implementing the Recovery Strategy in its entirety by addressing all of its stated broad objectives and corresponding approaches.

Although documented progress has been made and is expected to continue with the implementation of the Action Plan, the overall goal of the Recovery Strategy for Atlantic Whitefish has not yet been achieved, nor can arrestment of decline of the lake-resident population be confirmed. The rationale of the Committee on the Status of Endangered Wildife in Canada (COSEWIC) for designating and recently reassessing the species as being at risk of facing imminent extinction still applies.

To assist with the achievement of the recovery objectives of the Recovery Strategy, this Progress Report contains recommendations for continued improvements, including the following: issuing a SARA s. 58(4) Order to protect the critical habitat identified in the Recovery Strategy, continuing to better describe this identified critical habitat, as well as identifying any new areas of critical habitat as the species range is expanded. This report also recommends maintaining the current amended Recovery Strategy, its broad goal and objectives and implementing the recovery measures outlined in the associated Action Plan which reflect the current priority actions required to achieve the recovery goal for Atlantic Whitefish. Key to recovery success is adopting an adaptive management approach and ensuring the timely implementation of the measures required for recovery (as identified in the Action Plan) which will require the continued commitment and cooperation of the AWCRT and other partners including the potential establishment of new partnership arrangements, careful consideration and management of both financial and human resource requirements, as well as monitoring the effectiveness of implemented recovery efforts.

The next report on the implementation of the Recovery Strategy, and further progress towards meeting its objectives, will be reported on in an additional five years.

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1. Background

1.1 COSEWIC[1] species assessment information

Date of Assessment: November 2010

Common Name (population): Atlantic Whitefish

Scientific Name: *Coregonus huntsmani*

COSEWIC Status: Endangered

Reason for Designation: This species, a unique Canadian endemic present in only a single location, is restricted to three interconnected lakes in Nova Scotia. Its viability is threatened by illegal introduction of exotic fishes.

Canadian Occurrence: Nova Scotia

COSEWIC Status History: Designated Endangered in April 1984. Status re-examined and confirmed in November 2000 and November 2010.

1.2 Threats

1.2.1 Threats to the species at risk

Current threats

- Barriers to fish passage resulting from the construction of hydroelectric dams and water supply impoundments.
- Interactions with non-native fish species (e.g., Smallmouth Bass (*Micropterus dolomieu*), Chain Pickerel (*Esox niger*)).
- Acidification from land-based activities (e.g., construction or excavation activities such as roads, quarries, and mines).

Other threats of lower potential concern

- Sources of direct mortality (e.g., bycatch in recreational angling and other fisheries, entrainment of fish into water intakes, removals or mortality from sampling for scientific or recovery purposes).
- Fluctuations in lake levels from municipal water drawdown or irrigation.
- Acidification from acid rain or acid run-off from abandoned quarries and mines.

[1] Committee on the Status of Endangered Wildlife in Canada.

1.2.2 Threats to critical habitat

Critical habitat for Atlantic Whitefish has been identified in the Recovery Strategy as the three small, semi-natural, interconnected lakes in the Upper Petite Rivière (herein referred to as the Petite lakes), which support the existing wild population of Atlantic Whitefish: Milipsigate Lake, Minamkeak Lake, and Hebb Lake, as well as the waterways inter-connecting these three lakes (DFO 2016a). Please refer to the Recovery Strategy for details on the identified critical habitat, including its geographical area, any exclusions, and its biological and physical functions, features, and attributes. Table 1 includes examples of human activities and associated effects on Atlantic Whitefish critical habitat.

Table 1. Examples of human activities and associated effects on the biophysical functions, features, and attributes of the identified critical habitat (from DFO 2016a).

Activity	Effect-Pathway	Function Affected	Feature Affected	Attribute Affected
Infilling	Loss or change of established lake bottom and water column	Egg incubation, rearing, spawning, growth and/or feeding	Lake bottom, water column	Depth, water temperature, suspended sediment levels and bottom substrate quantity and type
Dredging	Loss or change of established lake bottom and water column	Egg incubation, rearing, spawning, growth and/or feeding	Lake bottom, water column	Depth, water temperature, suspended sediment levels and bottom substrate quantity and type
Significant manipulation of water levels outside standard operations	Decrease in water levels resulting in exposure of previously submerged areas, risk of exposure of eggs, reduced flows, altered thermal refugial habitat.	Egg incubation, rearing, spawning, growth and/or feeding	Nearshore areas, lake water column, and watercourses connecting lakes	Depth, water temperature and bottom substrate
Persistent and excessive releases of deleterious substances from land-based activities (e.g., road construction, quarry excavation or mining)	Degradation of water quality	Egg incubation, rearing, spawning, growth and/or feeding	Lake bottom, lake water column and watercourses connecting lakes	Water chemistry, water pH, temperature, suspended sediment levels and bottom substrate quantity and type

2. Recovery

2.1 Recovery goals and objectives

Recovery goal

"Achieve stability in the current population of Atlantic Whitefish in Nova Scotia, reestablishment of the anadromous form, and expansion beyond its current range."

Recovery objectives

Population objective: A minimum population size of >1,275 mature individuals in the Petite Rivière.

Distribution objective: Establishing self-sustaining anadromous populations in several watersheds in the Nova Scotia Southern Uplands eco-region, including the Petite Rivière.

Broad strategies

Broad strategy 1: Conserve, protect and manage the species and its habitat.

Broad strategy 2: Increase the number and range of viable populations.

Broad strategy 3: Address knowledge gaps relating to the species and its habitat.

Broad strategy 4: Increase public involvement in, and acceptance of, measures required for the species survival and recovery.

2.2 Performance indicators

The following general performance measures identified in the Recovery Strategy provide a way to define and measure the progress towards achieving the overall recovery goal and extent to which recovery activities are successful in contributing to the stated population and distribution objectives for the species.

Performance measures

1. Critical habitat has been identified and protected.
2. Research activities outlined in the Schedule of Studies (as outlined in the Recovery Strategy) have been completed.
3. Abundance of the existing wild population in the Petite lakes has been estimated and meets target (>1,275 mature adults).
4. Anadromy has been established on the Petite Rivière.

5. A self-sustaining population has been established in another freshwater waterbody (e.g., Anderson Lake).
6. Anadromy has been established in a second watershed in Nova Scotia's Southern Upland eco-region.
7. The feasibility of repatriating an anadromous run to the Tusket River has been evaluated and repatriation has been pursued if appropriate.
8. The threat posed by Smallmouth Bass is understood and appropriate mitigation and management measures are in place to control their abundance and ensure the survival of Atlantic Whitefish in the Petite Rivière.
9. Progress has been made towards filling the knowledge gaps identified in the Recovery Strategy.
10. An adaptive communication plan has been developed, engaged stewards are active, and public awareness and acceptance of the Atlantic Whitefish has increased and been expanded to new areas selected for introductions.
11. Human activities permitted by this recovery strategy do not and will not jeopardize the survival or recovery of the Atlantic Whitefish.
12. An Action Plan has been completed and is posted in the SAR Public Registry.

3. Progress towards recovery

This section provides information on the progress that has been made toward achieving the recovery goal and population and distribution objectives set for the Atlantic Whitefish in the Recovery Strategy, for the time period of February 2007 to February 2012.

Sections 3.1 and 3.2 summarize the achievements of science and management activities, including progress towards completing the critical habitat Schedule of Studies. Section 3.3 reports on the progress towards achieving the performance measures.

A more detailed account of significant actions completed or underway since the 2000 COSEWIC assessment of the species is provided in the amended Recovery Strategy (DFO 2016a). These include:

- Release of captive-reared individuals into a selected freshwater waterbody outside the Petite Rivière system (i.e., Anderson Lake) in an attempt to evaluate the feasibility of using captive-reared fish to establish successfully reproducing lake resident populations and to also attempt to create a back-up population of Atlantic Whitefish to minimize the species' risk of extinction.
- Attempts to increase natural production and promote anadromy on the Petite Rivière with releases of captive-reared individuals in the lower watershed and the recent provision of fish passage at Hebb Lake Dam.
- Increased public awareness, education, and community engagement mainly led by active non-government organization (NGO) members of the Atlantic Whitefish Conservation and Recovery Team (AWCRT or 'Recovery Team').

These recovery efforts and many of the other activities detailed below may not have been possible without the important collaborations of active member organizations of the Recovery Team and other partners.

3.1 Research/monitoring activities

Research

- A DFO scientific Recovery Potential Assessment (RPA) was conducted in March 2009 to consolidate new information on Atlantic Whitefish in preparation for COSEWIC's reassessment of the species status, as well as to support decisions on permitting of incidental harm and ongoing recovery planning efforts. The Science Advisory Report (SAR) (DFO 2009) and associated documents are available on the Canadian Science Advisory Secretariat website.
- Captive breeding and rearing methodology and culture techniques were successfully developed by DFO Science at the Mersey Biodiversity Facility, formerly owned and operated by DFO.
- Data has been acquired by DFO Science on the health (e.g., disease, parasites), life cycle, and behaviour of captive-reared Atlantic Whitefish.
- Milt cryopreservation viability experiments were undertaken by DFO Science. Species-specific protocols and techniques were developed for Atlantic Whitefish and a report was published (de Mestral Bezanson et al. 2010).
- Two trial releases of captive-reared Atlantic Whitefish, one in Anderson Lake (2005-2008) and one in Lower Petite Rivière (2007-2009), were undertaken by DFO Science. A small number of individuals from both sets of releases were implanted with acoustic transmitters and their movements monitored.
- Shoreline surveys of Smallmouth Bass nests, distribution, and evidence of reproduction have been conducted annually since 2007 on Minamkeak, Milipsigate, and Hebb Lakes by an active NGO member of the Recovery Team, the Bluenose Coastal Action Foundation (BCAF 2008), with support from the Nova Scotia Department of Fisheries and Aquaculture (NSDFA) and DFO Science.
- A survey of Oakland Lake, the protected water supply for the community of Mahone Bay, was conducted by DFO Science in 2007 and the lake was assessed as potentially suitable for Atlantic Whitefish introductions. BCAF subsequently undertook consultations with the Town of Mahone Bay and general support from the Town was received.
- Sampling gear evaluations and trapnet re-design has been undertaken by DFO Science in 2007 and 2008 in an attempt to increase catch rates for the acquisition of status and basic biological information on the existing wild population of Atlantic Whitefish in the Petite lakes.
- An article on the collaborative research between DFO Science and Acadia University on the ontogenetic development of Atlantic Whitefish was published in the primary literature (Hasselman et al. 2007).
- Criteria to distinguish adult and sub-adult Atlantic Whitefish from other coregonid species occurring within eastern Canada (i.e., Lake Whitefish (*Coregonus*

clupeaformis) and Round Whitefish (*Prosopium cylindraceum*)) using external characteristics have been developed (Hasselman et al. 2009).

Critical habitat schedule of studies

Research contributing to the implemention of the Schedule of Studies necessary to identify critical habitat (see Recovery Strategy, i.e., DFO 2006; 2016a):

- Evaluation of the spatial and temporal distribution of Atlantic Whitefish in the Petite Rivière watershed was accomplished annually by DFO Science during the period of 2000-2009. Data current to 2009 were reviewed during the RPA and incorporated into the supporting SAR (DFO 2009) and associated research documents. Ongoing outreach activities by NGO groups have also provided information.
- Bathymetry surveys of the Petite lakes were initiated in 2006 by Nova Scotia Power Inc. (NSPI), NSDFA, and BCAF, and are ongoing. Data acquisition is complete for two of the three lakes, and maps are currently available for Hebb and Milipsigate Lakes. Field reports are available on the BCAF website.
- Exploratory acoustic tracking studies on wild Atlantic Whitefish were conducted in Hebb Lake in 2006 to help identify habitat use and seasonal movements.
- Research on the trophic ecology of Atlantic Whitefish in the Petite lakes and their role in the lake ecosystems were initiated in 2005 and are supplemented as samples become available.
- Laboratory-based tolerance trials on the adaptability of Atlantic Whitefish to salt water, temperature, and pH were undertaken by a PhD student from Dalhousie University in collaboration with DFO Science and completed in 2007 and 2008 to evaluate the physiological constraints on anadromy. Results are incorporated into the SAR (DFO 2009) and an associated research document (Cook et al. 2010).

Monitoring

- DFO Science conducted fall monitoring of the Anderson Lake captive-reared Atlantic Whitefish introductions for signs of survival and reproduction annually through to December 2010.
- Monitoring to confirm the continued presence of wild Atlantic Whitefish in the three Petite lakes and below Hebb Dam was accomplished by DFO Science during the period of 2000-2009.
- Water quality monitoring has been ongoing annually over a number of years on the Tusket River watershed by NSPI, and on the Petite Rivière, including the lakes and estuary, by BCAF.

3.2 Management activities

- In 2011, DFO Fisheries Management, in collaboration with the Province of Nova Scotia, further reduced the angling season (July 1 to September 30) on the Petite lakes to reduce the risk to pre-spawning Atlantic Whitefish in the fall.
- Awareness signage was posted by DFO Conservation and Protection along the lower Petite Rivière and on the adjacent watersheds of Medway, LaHave, and Mersey Rivers.
- In November 2010, the Province of Nova Scotia was successful in amending the Provincial *Fisheries and Coastal Resources Act* to authorize the making of regulations that will make the possession of live fish illegal (with some exceptions)[2].
- An upgrade of all the dams on the Petite lakes by the Bridgewater Public Service Commission (BPSC) to meet Canadian Dam Safety Guidelines was undertaken in 2011. Dams at Hebb, Weagles, Milipsigate, and Minamkeak have been completed. Dam upgrades allow for the improved capacity to manage water levels important for Atlantic Whitefish, and consider future fish passage needs.
- Fisheries compliance monitoring in the Petite Rivière and adjacent watersheds (i.e., Mersey and Medway) as well as Anderson Lake were conducted on an ongoing basis by DFO Conservation and Protection staff.
- DFO Habitat Management (now Fisheries Protection Program) continued to review works and undertakings in accordance with the Habitat Protection Provisions of the *Fisheries Act*, and conducted habitat compliance monitoring in and around the Petite Rivière.

3.3 Summary of progress towards recovery

An assessment of the progress made toward the recovery of Atlantic Whitefish is summarized in Table 2.

[2] The *Live Fish Possession Regulations* came into effect on April 1st, 2013.

Table 2. Summary of recovery progress as measured against the twelve performance measures.

#	Performance Measure	Status	Activity Summary & Key Outcomes	Partners[1]
1	Critical habitat a) identified b) protected	 a) Yes b) Not yet	a) Critical habitat necessary for survival has been identified in the 2016 amended Recovery Strategy. A Schedule of Studies outlines the studies necessary to identify additional critical habitat required for recovery. b) Critical habitat will be protected by a SARA Order due 180 days from publishing of the final Recovery Strategy.	DFO SARMD, HMD, and Science
2	Critical Habitat Schedule of Studies completed	No, Ongoing	Several research activities have been undertaken and are ongoing (see Section 3.1).	DFO Science, NSPI, NSDFA, BCAF
3	Abundance of Petite population has been estimated and meets target	No, Ongoing	Efforts were made (2000-2008) but an abundance estimate remains unknown. Sampling has, however, confirmed the continued presence of individuals within the Petite lakes.	DFO
4	Anadromy has been established on the Petite Rivière	No, Initiated	In spring 2012, a fish passage facility was constructed at Hebb Dam, the dam at the foot of the Petite lakes, which is expected to begin to create the conditions necessary to enable anadromy on the Petite. An interim monitoring plan has been developed and a removal fish trap installed within the facility. Fish passage to fully connect all three lakes to tidal waters remains incomplete. Preliminary designs have been drafted and opportunities continue to be sought at other locations.	BPSC, NSPI, and DFO (SARMD, Science, and HMD)
5	A population has been established in another freshwater waterbody	No, Initiated	Captive-reared Atlantic Whitefish were released (2005-2008) into a select lake outside the Petite Rivière, i.e., Anderson Lake. Annual monitoring was undertaken between 2005 and December 2010. Released fish are surviving and showing signs of maturation. Other freshwater lakes continue to be explored and identified as potential candidates (e.g., Oakland Lake).	DFO Science, BCAF

#	Performance Measure	Status	Activity Summary & Key Outcomes	Partners[1]
6	Anadromy has been established in a second watershed	No, Not started	Anadromy has not been established or attempted in another watershed in southwestern Nova Scotia to date but the results of tolerance experiments and recent modeling of watersheds would provide some of the criteria necessary to evaluate habitat suitability. Measures are outlined in the Action Plan.	
7	Feasibility of repatriating the Tusket River has been assessed/evaluated	No, Initiated	Discussions with the Recovery Team and initial consultations with the local advisory committee have presented the outline of a potential scientific experiment.	DFO Science
8	Threat of Smallmouth Bass a) understood; b) mitigation and management measures in place	No, Initiated	a) Surveys of Smallmouth Bass have been conducted annually on the Petite lakes since 2007. Preliminary results are available and continued monitoring is in effect. See Section 3.1. b) Measures to evaluate the results and implement mitigation are outlined in the Action Plan.	BCAF, NSDFA
9	Progress has been made towards filling knowledge gaps	Yes, Ongoing	See Section 3.1 for details of activities accomplished. Gaps are anticipated to continue to be both filled and unfold as research and monitoring activities are undertaken and recovery efforts progress.	DFO Science and various AWCRT partners
10	Communication plan developed, stewards engaged, public awareness and acceptance increased	Yes, Ongoing	A number of activities have had a significant impact on raising public awareness and engaging stewards in Atlantic Whitefish conservation and recovery efforts. Those include (but are not limited to): Ongoing efforts of the Communications Subcommittee of the Recovery Team, development of a draft communication plan, development and distribution of communication products, participation in public events, media attention, community meetings and workshops, installation of display panels and signage at strategic locations, establishment of a live display at Fisheries Museum of the Atlantic, continued airing of the Hinterland Who's Who vignette.	Various AWCRT partners

#	Performance Measure	Status	Activity Summary & Key Outcomes	Partners[1]
11	Human activities permitted by Recovery Strategy do not and will not jeopardize survival or recovery	Yes, Ongoing	Hebb Dam is no longer considered a barrier to fish movement since construction of the fish passage facility in 2012. Activities evaluated during the 2009 RPA and additional activities are included in the amended Recovery Strategy. These will be monitored and evaluated in the next 5-year Progress Report.	DFO Science, FM, and SARMD
12	Action Plan completed and posted on the Species at Risk Public Registry.	Yes, Completed	An Action Plan which presents the recovery measures necessary to fully implement the Recovery Strategy in addressing the Atlantic Whitefish's entire global distribution has been concurrently completed with this Progress Report and posted on the Species at Risk Public Registry.	DFO SARMD in collaboration with the AWCRT

[1] Acronyms used in table:
BCAF - Bluenose Coastal Action Foundation
AWCRT - Atlantic Whitefish Conservation and Recovery Team
DFO - Fisheries and Oceans Canada
FM - Fisheries Management
HMD – Habitat Management Division (now FPP)
NSDFA - Nova Scotia Department of Fisheries and Aquaculture
NSPI – Nova Scotia Power Inc.
SARMD - Species at Risk Management Division

4. Recommendations

4.1 Guiding questions

Recommendations are guided by a series of questions related to the information provided in Section 3:

1. *Question:* Has sufficient critical habitat been identified to support the recovery objectives (including population and distribution objectives) for the species at risk?
   Answer: No, only a partial identification is provided.

Supporting narrative: Critical habitat has been identified in the Recovery Strategy as the three lakes in the upper Petite Rivière; i.e., Minamkeak, Milipsigate, and Hebb, including the waterways inter-connecting these lakes. Wild Atlantic Whitefish are not presently found anywhere else (as a self-sustaining population) and therefore this is the habitat deemed necessary for the species' survival in the Petite Rivière. Fully achieving the recovery objectives for Atlantic Whitefish requires the establishment of anadromy on the Petite Rivière as well as the establishment of other viable anadromous populations. Furthermore, the specific locations of the features within the Petite lakes which provide for the required functions are not well known but could be better described with further research. It is expected that the critical habitat requirements for Atlantic Whitefish will change as the recovery objectives for anadromy within the Petite Rivière and range extension are successfully implemented. The Schedule of Studies in the Recovery Strategy accordingly outlines the research activities required to refine the current description of critical habitat within the Petite lakes to support its protection and to identify any additional habitat areas required for the species subsequent recovery, such that all required critical habitat is eventually identified to fully achieve the population and distribution objectives for the species.

2. Based on the knowledge accumulated to date, including that on critical habitat:
   a. *Question:* Is recovery as stated in the Recovery Strategy still considered feasible?
      Answer: Yes.

Supporting narrative: Recovery of Atlantic Whitefish, as stated in the Recovery Strategy, is still considered to be both biologically and technically feasible. The original feasibility determination has been updated in the amended Recovery Strategy to include new information including how monitoring of releases of Atlantic Whitefish into Anderson Lake between 2005 and 2010 showed positive signs of success and confirmation that captive-bred individuals can be used to establish new populations. The results of research have demonstrated that the Petite Rivière population has retained the physiological capacity for anadromy and watershed modeling has provided support that many drainages in the Southern Upland eco-region of Nova Scotia can be considered as candidate sites for establishing new populations. Fish passage improvements on the Petite Rivière have commenced and captive-breeding techniques have been perfected over the years.

The RPA, however, concluded that the time to recovery is dependent both upon the current status of the remaining population in the Petite lakes and the timing and extent of human intervention. A DFO Science captive-breeding program for Atlantic Whitefish was successfully developed and was operational from 2000-2012. This DFO-led program concluded in the spring of 2012. There may be some technical challenges in achieving the overall goal and distribution objective for this species without an operating captive-breeding program, at least until another viable mechanism can be evaluated and supported. An immediate priority is to ensure that the captive-breeding techniques and methods that have been developed and proven to be successful are fully and permanently documented by DFO. Going forward, identifying viable mechanisms, partnering opportunities, and arrangements will be essential to implement the recovery measures required to achieve the distribution objective for this species, which is: establishing self-sustaining anadromous populations in several watersheds in the Nova Scotia Southern Upland eco-region, including the Petite Rivière.

b. *Question:* Are the population and distribution objectives, as well as the broad strategies for recovery still relevant and realistic?
Answer: Yes.

Supporting narrative: The Recovery Strategy has concurrently been amended with the development of this Progress Report to take into account new information from the 2009 RPA. This new information allowed for the establishment of population and distribution objectives which are deemed reasonable given the state of present knowledge on the species and its needs. The amended Recovery Strategy maintains the four identified broad strategies, which remain relevant and realistic for Atlantic Whitefish recovery.

c. *Question:* Is there a need to shift the priorities set for the various Recovery Strategy implementation activities?
Answer: No.

Supporting narrative: An Action Plan has been prepared in concurrence with the amended Recovery Strategy and this document which presents all the recovery measures deemed necessary to address the Atlantic Whitefish's entire global distribution and fully implement the Recovery Strategy. Priority levels are assigned to each recovery measure to reflect the direct impact a measure is expected to have on addressing the stated threat or concern, and thus the likelihood of the activity contributing to the survival or recovery of the species. These reflect the current priorities for recovery implementation.

3. *Question:* Is there sufficient information, including peer-reviewed evidence, at this time to recommend the re-evaluation of the current status of the species?
Answer: No.

Supporting narrative: COSEWIC reassessed and confirmed the 'Endangered' status for Atlantic Whitefish in November 2010 (COSEWIC 2010). This reassessment drew upon the peer-reviewed information resulting from the 2009 RPA process. Given the RPA's consolidation of new information on Atlantic Whitefish in preparation for reassessment by COSEWIC, and the status of more recent recovery efforts and state of knowledge since that time, it is felt that there is not sufficient new information to warrant a re-evaluation of the species status at this time.

4.2 Recommendations

Key to achieving the overall recovery objectives for Atlantic Whitefish is the continued and timely implementation and monitoring of priority recovery measures and actions, as specified in the concurrently published Action Plan (DFO 2016b). This requires the careful consideration and management of funding requirements, available resources, and potential opportunities; the maintenance of existing partnerships and establishment of new partnering arrangements; the continuation and initiation of various scientific studies and endeavours required to address uncertainties; the continuation of outreach programs aimed at compliance promotion, etc. Recommendations therefore include ensuring an enabling environment to facilitate the implementation of necessary recovery measures identified in the Action Plan, including, but not limited to, the following high priority measures (importance not necessarily implied by order):

- Continue to monitor and strive to acquire a population abundance for the existing wild population of Atlantic Whitefish in the Petite lakes.
- Continue to monitor Atlantic Whitefish in Anderson Lake to evaluate the status and condition of the species in that location.
- Range expansion: Evaluate and pursue options for anadromous introductions in rivers of the western Southern Upland Nova Scotia eco-region, including consideration of the Tusket River. Implementation of this recovery measure would be contingent upon:
  - Documenting the Atlantic Whitefish captive-breeding techniques and methodologies that have been successfully developed and used to date.
  - Identifying viable mechanisms and partnering arrangements to support future introduction needs.
  - Community and stakeholder support in new locations.
- Develop, implement, and evaluate mitigation measures to address the threat posed by Smallmouth Bass and Chain Pickerel.
- Monitor fish usage and passage at the newly constructed fish passage facility at Hebb Lake Dam.
- Continue to improve fish passage throughout the Petite Rivière watershed.
- Undertake the habitat research studies outlined in the critical habitat Schedule of Studies.
- Continue to encourage a partnered approach to conserving, protecting, and recovering Atlantic Whitefish and their supporting habitats.
- Adopt an adaptive management approach to the implementation of all future recovery measures. This will be essential to ensuring the survival of the species

within its existing habitat, to addressing any new emergent threats, and to ensuring the success of range expansion activities.

In summary, based on the information provided herein, this report recommends issuing a SARA Critical Habitat Order to protect the identified critical habitat, continue to better describe this identified critical habitat as new information becomes available, and identify any new areas of critical habitat as anadromy is established on the Petite Rivière and the species range is expanded into new areas. This report also recommends maintaining the current amended Recovery Strategy and implementing the recovery measures outlined in the associated Action Plan.

Recovery success will be most readily achieved by ensuring an enabling environment for the timely and prioritized implementation recovery measures (as identified in the Action Plan), monitoring the effectiveness of those efforts, and by adopting an adaptive management approach to recovery measure implementation.

5. References

BCAF (Bluenose Coastal Action Foundation). 2008. The Atlantic whitefish recovery project: smallmouth bass habitat and distribution study. 15pp. [accessed February 2016].

Cook, A.M., R.G. Bradford, B. Hubley, and P. Bentzen. 2010. Effects of pH, temperature and salinity on age-0+ Atlantic Whitefish (*Coregonus huntsmani*) with implications for recovery potential. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/055. vi + 47 pp.

COSEWIC. 2010. Update COSEWIC status report on Atlantic Whitefish *Coregonus huntsmani* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 29 pp.

de Mestral Bezanson, L., P. O'Reilly, B. Lenentine, and J. Whitelaw. 2010. Cryopreservation of milt from two endangered fishes: Atlantic Whitefish (*Coregonus huntsmani*) and inner Bay of Fundy Atlantic Salmon (*Salmo salar*). Can. Tech. Rep. Fish. Aquat. Sci: 2911. vi+18pp.

DFO. 2006. Recovery Strategy for the Atlantic Whitefish (*Coregonus hunstmani*) in Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. v + 42 pp.

DFO. 2009. Recovery Potential Assessment for Atlantic Whitefish (*Coregonus hunstmani*). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/051.

DFO. 2016a. Amended Recovery Strategy for the Atlantic Whitefish (*Coregonus hunstmani*) in Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. xiii + 60 pp.

DFO. 2016b. Action Plan for the Atlantic Whitefish (*Coregonus hunstmani*) in Canada. Species at Risk Act Action Plan Series. Fisheries and Oceans Canada, Ottawa. ix + 39 pp.

Hasselman, D.J., J. Whitelaw, and R.G. Bradford 2007. Ontogenetic development of the endangered Atlantic whitefish (*Coregonus huntsmani* Scott, 1987) eggs, larvae, and juveniles. Canadian Journal of Zoology 85: 1157-1168.

Hasselman, D.J., T.A. Edge, and R.G. Bradford. 2009. Discrimination of the endangered Atlantic whitefish from lake whitefish and round whitefish by the use of external characters. North American Journal of Fisheries Management 29(4): 1046-1057.

Appendix A: Atlantic Whitefish Conservation and Recovery Team membership

Organization	Active Members
Bluenose Coastal Action Foundation	Nodding, Brooke
Bridgewater – Public Service Commission	Hiltz, Tim Larry Hood
DFO, Science	Bradford, Rod Whitelaw, John
DFO, Fisheries Management	Stevens, Greg Frank Quinn (co-Chair)
DFO, Species at Risk Management Division	Robichaud-LeBlanc, Kim
DFO, Habitat Management	Wheaton, Thomas Longard, Dave MacLean, Melanie
DFO, Conservation and Protection	Wolfe, William Burgess, Roland
DFO, Communications	Gaulton, Luke
DFO, Policy and Economics	MacIntosh, Robert
Native Council of Nova Scotia – Zone 5	Stevens, Jeff
Nova Scotia Dept. of Fisheries and Aquaculture	LeBlanc, Jason
Nova Scotia Museum of Natural History	Gilhen, John (co-Chair)
Nova Scotia Power Corporation	Nicolas, Jean-Marc
Maritime Aboriginal Peoples Council	McNeely, Joshua
Nature Nova Scotia	Comolli, Jill